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EDITORIAL

THE CONTROL OF DISEASES OF RABBITS

WHILE diseases of rabbits have always had a certain measure of importance at the present time, a knowledge concerning their control forms one of the essential parts of our national war effort. The encouragement given to the keeping of rabbits, the formation of numerous rabbit clubs and the part played by the rabbit in the nation's food, have all given a high impetus to the increasing of rabbit stocks throughout the country. In many cases, it is feared, those who have taken up rabbit keeping on either a small or a large scale, may have done so without much knowledge of ordinary rabbit husbandry or of the diseases which may affect the stock or their control. It is also true that our knowledge of diseases affecting rabbits is incomplete. A similar state of affairs existed in poultry, when the great increase in poultry keeping took place in the immediate post-war period from 1919. It was only by patient research and field application of the results of research work that our knowledge of poultry husbandry and disease control reached a state of economic stability. While some of the diseases affecting rabbits have not yet been fully studied, we have some information which can be applied, and it behoves all of us to make ourselves familiar with what is known at the present time. It has, doubtless, been the experience of many of us that we have been only infrequently consulted on rabbit troubles. Veterinary practitioners and laboratory workers are now being asked more and more to advise on the problems of rabbit keeping and disease control.

In this issue of THE VETERINARY JOURNAL is reproduced a valuable article on "Diseases of the Rabbit." It represents much of the up-to-date knowledge of the subject and is based to some extent upon the personal experiences of the author from work in the post-mortem room.

Rabbits suffer from diseases, some of which are specific in nature. An understanding of diseases of other domestic animals, while of considerable value in a general measure, cannot replace the necessary intimate knowledge of rabbit diseases. The present article should be found of much value in assisting veterinary practitioners and other workers with the diagnosis and control of the common types of disease met with in rabbits to-day.

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General Articles

DISEASES OF THE RABBIT*

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Weybridge

UNFORTUNATELY there is nearly a complete absence of reliable information on rabbit pathology, so that it is difficult to assess the incidence of the various diseases, or to appreciate their relative importance. The diseases described are selected from the records of our post-mortem examinations, and their importance stressed according to the frequency with which we have encountered them.

Owing to the somewhat similar methods of management, and the same low economic value of the individual animal, the control measures to be used for the infectious diseases of rabbits broadly follow the same lines as those for poultry. The medicinal treatment of rabbits affected with an infectious disease is uneconomic and can never be recommended, as, if once attempted, it is extremely difficult to limit the spread of infection. Immediately an infectious disease has been diagnosed all affected or weakly animals should be destroyed, and the carcases burned or buried. The hutches and all utensils used in feeding or watering should be thoroughly cleaned by scrubbing with a four per cent. solution of washing soda in hot water, and disinfected with a three per cent. compound cresol solution, or five per cent. carbolic solution. All bedding and litter must be burned. Rabbits in contact with diseased animals should be isolated from remaining healthy stock and, if possible, animals in isolation should have a separate attendant and should always be attended to last. Footbaths of disinfectant should be placed outside infected pens.

As in poultry diseases, diagnosis of most of the infectious diseases of rabbits can only be satisfactorily carried out in a properly equipped laboratory, and the first step whenever mortality is experienced, or infectious disease suspected, is to send a carcase to a veterinary laboratory and while awaiting the diagnosis to put in force the broad principles of disinfection just described. Once the diagnosis has been established the more specific control measures can be adopted.

The specific diseases can be subdivided into:

A.—Bacterial infections.
B.—Protozoan diseases.
C.—Diseases due to fungi, and
D.—Metazoan parasites.

A.—*Bacterial infections*

(1) *Tuberculosis.* The rabbit is experimentally susceptible to all three strains

* This paper was presented at a refresher course for County Poultry Instructors, held at Harper Adams Agricultural College, during September, 1942. Owing to the vast increase in rabbit keeping, particularly in urban districts, veterinary surgeons are being consulted more frequently on rabbit diseases and, as there is a lack of concise information on this subject, it is hoped that this summary may be of value, despite the fact that it was written primarily for laymen.

of the tubercle bacillus. Artificially it is more susceptible to the bovine strain than to the avian or human, and although there is no definite evidence as to whether this is the case in natural infection, our impression from post-mortem examinations of affected rabits is that it is most commonly the bovine strain which is involved.

It is difficult, owing to lack of statistics, to assess the incidence of T.B. in domesticated rabbits, but while our records would show the disease to be fairly common it does not appear to assume the same epidemic proportions as in other animals. This may possibly be due to the fact that, generally speaking, rabbits are fairly well segregated in hutches.

Symptoms. These vary enormously, depending on the type of infection. In the acute miliary form the animal may appear perfectly normal three or four days before death, but for the last two or three days it will be obviously ill and distressed, with laboured breathing and a comatose appearance. There is no marked loss of condition. In the chronic form, however, there is progressive loss of weight over a period of three or four weeks. At first appetite remains good, but diarrhœa may supervene, and weakness of movement may be observed. There is marked loss of condition, with emaciation, particularly along the spine. Respiration is increased towards the end. In this form of the disease, which is probably the more common, the condition may go unnoticed for some time, so gradual is the emaciation.

Post-mortem Appearance. In the miliary or acute type, multiple small pin-point, yellowish-white granules are found throughout the lungs, liver, spleen and kidneys. In the chronic form usually only the lungs are involved, when there is complete consolidation of both lungs with little normal tissue remaining, the tubercules appearing as large grey-white areas of caseation. In both forms the lesions can only be differentiated from those of pseudo-tuberculosis, or of hepatic coccidiosis, by the microscopical examination of smears.

The spread of the disease probably occurs most commonly by the feeding of milk from tuberculous cows, although once it is in a rabbitry it can spread from rabbit to rabbit. It may be introduced by the purchase of an infected animal.

A tuberculous attendant may spread the disease, and in the United States this is regarded as a most common method, owing to the frequency with which tuberculous people start rabbit farming in order to lead an open-air life. Infection may also occur from food or water contaminated by tuberculous cows, or even by wild rabbits, although the disease is probably rare in the latter. Infected rabbits must be destroyed, the carcases burned, and thorough disinfection carried out.

(2) *Pseudo-tuberculosis.* This is an infectious disease resembling tuberculosis both clinically and pathologically, and is caused by the organism *Pasteurella pseudo-tuberculosis rodentium.* Although the disease is not mentioned with any degree of frequency in the literature on rabbit diseases, we have encountered it on numerous occasions, and it is highly probable that, owing to its close resemblance to T.B., many cases of pseudo-T.B. have in the past been wrongly classified. The disease runs a chronic course of three to four weeks, usually ending in death. There is progressive weakness and emaciation, often unnoticed in the early stages, loss of appetite, difficulty in movement and laboured respira-

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tion. Post-mortem examination shows the presence of numerous small white cheesy nodules scattered throughout both lungs, and similar nodules may be seen in the liver, spleen, kidneys and wall of the intestinal tract. There is no treatment of value, and affected animals should be destroyed, carcases burned and disinfection carried out. Outbreaks of the disease may occur at any age, and although the Americans claim that losses may be high, we have not encountered the disease in epidemic form. In most cases it has been difficult to trace the origin, but in two outbreaks observed it originated in purchased stock, and in another was apparently introduced in vegetables found to be heavily contaminated by infected vermin.

(3) *Snuffles (or contagious catarrh).* This disease is referred to as the commonest and most serious condition in rabbits, frequently decimating complete rabbitries, but in the many hundreds of post-mortem examinations carried out we have never seen epidemics of this disease, although individual cases have been met with. Whether this is a true indication of the present rarity of the disease it is difficult to say, but it is more probably due to the fact that the disease is so well recognised by breeders that carcases are not sent for examination. At the same time, improved hygiene and housing may be responsible for a decrease in the incidence of the disease.

Contagious catarrh is characterised by inflammation of the mucous membrane of the nasal passages and sinuses of the head, and while there is still some doubt regarding the cause of the disease, there are at last two organisms which are constantly found either singly or together in the nasal discharge and affected tissues. These are *Bacillus bronchisepticus* and *Pasteurella lepisepticum.* These two organisms have also been found in the air passages of normal rabbits, and it has been suggested that certain unfavourable conditions, tending to lower the resistance of these animals, enable the organisms to become pathogenic.

Symptoms. In its most common form the disease runs a chronic course, manifesting itself as a persistent white, tenacious nasal discharge, frequently accompanied by a dried crust of the exudate around the nostrils. There is continued sneezing and apparent nasal obstruction, with a marked tendency for the animal to rub its nose on its paws, the fur of which becomes soiled and matted. As the disease progresses there is considerable wasting and weakness, often ending in death. A certain number of affected animals recover, and probably remain as carriers, and later these survivors, under the same conditions which lowered their resistance, may again develop the disease. Occasionally the disease is acute, the animal dying after a few days' illness with symptoms of pleurisy and pneumonia.

Occasionally a mild inflammation of the nasal mucosa with a slight discharge, probably a common cold, is mistaken for snuffles, and such cases should be isolated in dry, well-ventilated and light hutches, until the true nature of the disease is determined. Once snuffles is definitely diagnosed, no treatment is of value, and it is more profitable to destroy the animals quickly than to attempt isolation. The usual disinfection should then be undertaken.

If new stock is brought in, it should be isolated for 14 days, and during this time carefully watched and, if possible, fed by a separate attendant. Similarly with animals returned from shows, and all crates or boxes should be

thoroughly disinfected. It should be remembered that the disease is usually associated with badly fed stock, housed under unhygienic conditions.

(4) *Schmorl's Disease* (*or necrobacillosis*). This is an ulcerative condition of an infectious nature, caused by the organism *Fusiformis necrophorus*. The organism usually enters the body through small wounds caused by scratching or biting, or small abrasions around the mouth caused by coarse food. The disease is characterised by a progressive necrosis and ulceration of the skin of various portions of the face, or by abscess formation in different parts of the body. The symptoms vary considerably, depending on the point of entry of the germ, but usually shows first as a painful purplish swelling of the upper lip which gradually spreads until the whole face is involved. In other cases the infectious process may begin as a swelling of the lower lip and extend slowly under the jaw and throat to the region of the chest. There is gradual death of the affected skin and underlying tissues, with eventual sloughing. The surface of the wound thus exposed has a dirty greyish-white appearance, and is hard and necrotic. In very progressive cases there may occur more or less severe ulcration of the skin of the hind legs and round the vent. In a few cases there may be no involvement of the face, but abscesses ranging in size from that of a pea to a walnut may be seen on the thighs and flanks. The wall of the abscess is thick and fibrous, and contains a creamy yellow pus.

Affected animals have great difficulty in moving their jaws, and in consequence eat little and soon show weakness and emaciation, and after an illness of two to several weeks succumb to the disease. Pleurisy and pneumonia are frequent sequels. On post-mortem examination there may be evidence of pneumonia, with consolidation of the lungs and fluid in the chest cavity, while abscesses similar to those on the skin may be found in the visceral organs. Treatment is not usually successful, except in the case of a few local abscesses, and should only be attempted in the case of valuable animals. Preventive measures are the more important and consist in the usual destruction of affected animals, burning of carcases, litter and soiled food, and cleansing and disinfection of houses and utensils.

(5) *Strangles*. This condition is one in which an abscess caused by a streptococcus develops in the region of the lower jaw. Frequently the bones of the jaw are involved as well as the surrounding tissues. These abscesses are of variable size, sometimes as large as a tennis ball and are firm to the touch. They do not tend to burst spontaneously, and require to be opened surgically in order to remove the contents, which are a thick greyish-yellow pus. The condition is not usually fatal unless the abscess is neglected, when it can assume large proportions, and may involve vital structures. The usual hygienic measures should be carried out.

(6) *Hæmorrhagic Septicæmia*. This is an acute infectious disease caused by *Pasteurella cuniculicida*. Fortunately the disease is extremely rare in rabbits in this country. The disease has a high mortality rate and as a rule runs a rapid course, the animal dying in 24 to 36 hours. Infection is usually by the ingestion of food or water contaminated by the discharges of affected animals. Symptoms are indefinite. There is a high temperature, dull coat, listlessness, inappetence and diarrhœa, followed by coma. The disease is difficult to detect, as death is so

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sudden, and frequently the animal merely appears out of sorts for a few hours before death. The post-mortem findings in acute cases are limited to congestion of the visceral organs and engorgement of the blood vessels. Restricted hæmorrhages may be seen in the heart wall, and congestion of the lungs is usually present. Definite diagnosis can only be made on bacteriological examination. Affected animals must be destroyed and the carcases burned. Disinfection and hygienic measures must be thoroughly carried out and the premises left vacant for some time before restocking. In countries where the disease is common, preventive treatment is carried out by the use of vaccines.

(7) *Salmonella Infection.* There are few references to the occurrence of Salmonella infections in rabbits; but we have encountered a few epidemics in young stock in which *S. ærtrycke* (*S. typhi-murium*) was considered to be the infective agent. *S. enteritidis gærtner* has also been recovered on a few occasions. Both organisms are widespread in nature, causing disease in most species of animals and are common causes of food poisoning in man. They are the cause of heavy losses in chicks and ducklings and are common in vermin, and, as in poultry, it is probable that most outbreaks originate in food, water, and bedding, contaminated by the excreta of infected vermin. Young rabbits are the most susceptible, and the symptoms are those of any septicæmic disease: high temperature, dullness and diarrhœa, death often being preceded by either coma or convulsions. Post-mortem lesions are neither characteristic nor constant, and diagnosis can only be made by cultural examination. Control measures depend on the destruction of the affected litter, disposal of the carcases and the usual disinfection of houses and utensils. Every effort should be made to exterminate vermin and food stores should be vermin-proof. The disease can easily be confused with acute coccidiosis.

(8) *Vent Disease* (*or rabbit syphilis*). This is a true venereal disease caused by the organism *Treponema cuniculi*, which is closely related to *T. pallidum*, the casual organism of syphilis in man. Rabbit syphilis is not transmissible to the human being. There is an extensive literature on this subject and the disease is considered to be extremely common. It is estimated that some 30 to 40 per cent. of wild rabbits are affected, and in rabbitries the disease may become epidemic. It is not so serious a condition as in man, the organism usually remaining localised in the affected part with no tendency to generalisation throughout the body. The casual organism is present in the sores of the affected organs, and is transmitted during mating. The symptoms are the appearance of small scaly sores on the genital organs, often slightly eroded, and covered with a brownish crust. They vary considerably in size and severity, and sometimes the patches are accompanied by swelling, especially in the doe, when the vulva may be twice its normal size. Occasionally lesions are found around the nostrils and eyelids. The sores may heal spontaneously, and the disease responds fairly readily to local treatment with mercurial ointments. Treatment has also been successfully carried out by the inoculation of arsenical preparations, similar to those used in the human subject, such as neosalvarsam. Prevention consists in the careful examination of bucks and does before service, and the isolation of suspects. Hutches should be disinfected and particular care taken to destroy all contaminated bedding. It must be remembered that any inflamed or ulcerated

condition of the vent is usually termed vent disease, but this may be due to a variety of causes, such as injuries, soiling of the parts following diarrhœa, or irritation from parasites. All these forms respond to treatment by cleansing, swabbing, and dressing with antiseptic ointments.

B.—*The Protozoan Diseases*

In this group there is only one important disease to be dealt with—that is, coccidiosis; and it is probably the commonest and most serious disease in rabbits. It is of very common occurrence in both wild and domesticated rabbits, and, as in the fowl, the species of coccidia of the rabbit are host specific; that is, the rabbit is not susceptible to the coccidia of other animals or *vice versa*. Again, as in fowls, some rabbits may harbour the parasite without showing symptoms of disease, and can act as carriers by transmitting the organisms in their droppings. In young stock the disease usually occurs in epidemic form, showing a rapid course and a mortality which may be as high as 70 to 100 per cent. of the affected litter. The parasite undergoes a complicated life cycle, part of which is spent in the ground and part in the host, and infection occurs when the rabbit swallows the ripe oocyst or ground form. These oocysts, which contain four spores, have a protective envelope which is dissolved by the gastric juices of the stomach, and the parasites, two from each spore, then attack the epithelial cells of the liver or intestinal wall, and multiply with great rapidity. After a series of phases in the body cells the parasites again form oocysts, which are passed out in the droppings. On the ground the oocyst undergoes a ripening or sporulating process lasting two to 16 days, according to certain conditions of temperature and humidity, and are then again ready to infect a new host, or to reinfect the original host. It is important to remember that the parasite is not infective until this period of sporulation has taken place, and this point is utilised in the control of the disease.

There are two forms of coccidiosis in the rabbit:

(1) *The liver or hepatic form,* caused by *Eimeria stiedæ,* and

(2) *The intestinal form,* caused by *E. perforans.*

In both forms the oocysts are discharged in the droppings, and in the diagnosis of the disease by examination of fæces it is necessary to differentiate these two forms. A third form of the disease, known as nasal coccidiosis, in which the parasite is found in the nasal discharges, has been reported, but at the moment there is insufficient evidence regarding this form of the disease, if it does occur. Symptoms in young animals are usually acute, and death may occur in two to three days without apparent ill-health. In less acute cases there is dullness and ravenous appetite, followed by rapid emaciation. Diarrhœa is usually present, followed by coma or convulsions immediately before death. Older animals become dull and listless, the coat is staring and the fur rough and easily pulled out. Loss of appetite is accompanied by progressive emaciation, and the animal has a pot-bellied appearance. There is frequently diarrhœa, with soiling of the hindquarters and gradual weakness of the hind limbs. On post-mortem examination the liver is slightly enlarged and shows multiple white spots, pin's-head to pea in size. The bile ducts are thickened, and appear as irregular white streaks on the surface of the liver. Under the microscope the coccidia can

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be demonstrated in vast numbers in smears from the affected liver, bile ducts and gall bladder.

Microscopic examination is necessary to differentiate the disease from tuberculosis or pseudo-tuberculosis. In the intestinal form the intestines show a catarrhal inflammation, and the wall may be thickened, and multiple white nodules may be present. There is no treatment of known value for coccidiosis in rabbits, and when the disease is diagnosed all affected or sick animals should be immediately destroyed, and the carcases burned. In fact, the whole litter should be killed, for survivors usually remain as carriers. The hutches should be scraped, and the litter, scrapings, and droppings, burned. The hutches and utensils should then be scrubbed with hot water containing four per cent. washing soda and finally disinfected with a 10 per cent. watery solution of household ammonia. In the prevention of the disease advantage is taken of the fact that the oocysts are not infective until at least two days after they have been passed in droppings, and require a moist warm temperature for sporulation. This is done by keeping the hutches clean and dry, and by daily removals of the manure. The best method of carrying this out is by the use of wire floors with sliding trays underneath. Even then the hutches should be cleaned at least twice a week, and the floors and walls scrubbed with the ammonia solution. Food and water containers should be raised above the floor of the hutch to prevent contamination by fæces, and wet areas should not be allowed to occur in the litter. Food and water utensils must be kept scrupulously clean, and should be scalded daily. Hutches should be light and well ventilated. Coccidiosis may be introduced by the use of secondhand hutches and utensils, or by food grown on ground manured with rabbit fæces, or contaminated by wild rabbits. Rabbit manure should be moved as far as possible from the rabbitry and should never be used to manure vegetables to be fed to rabbits. Since adults are frequently carriers, young stock must be isolated from older rabbits as soon as possible, and overcrowding should be avoided.

Also in this group of diseases, although so far it is difficult to classify it, we must consider a condition in rabbits at present under investigation at Weybridge. In our experience it is at the moment, at least in the south-east of England, the second commonest and most serious disease affecting rabbits. The losses amongst young stock are extremely high, whole litter after litter being affected, and many owners have found the greatest difficulty in rearing young stock. The disease was first brought to our notice over 12 months ago, and since then we have encountered some 200 outbreaks. The mortality varies enormously, from a few rabbits to, in some rabbitries, more than a 100 young animals, depending usually on the number of litters affected. Usually, once the disease shows itself in a litter, the complete litter is lost, or has to be destroyed. The cause is not, so far, known, but it is not bacterial in origin, and may possibly be due to a filtrable virus, since in many cases it would appear to be infectious. Under natural conditions, although the disease spreads rapidly within a litter, it has been found that frequently the young on either side of an affected litter may remain normal. The disease usually affects rabbits between two to 12 weeks of age, and is commonest about weaning time, although older rabbits and even bucks and does have been known to be affected. As a rule, mothers of affected

litters as well as the bucks with which they were mated remain apparently normal.

There are usually no premonitory symptoms, rabbits simply being found dead, or occasionally showing paralytic or convulsive symptoms for a few hours before death. Some owners state that affected rabbits cry out as if in pain immediately before death, and that the head is bent back rigidly towards the spine. Survivors in an affected litter usually show stunted growth. On post-mortem examination all organs appear normal, and, so far, we have been unable to find the exact pathological process concerned. Occasionally there may be some slight greyish streaks on the surface of the liver. The gall bladder may be distended and its contents thick and creamy, varying in colour from yellowish-green to dark brown. Coccidia are sometimes present but are obviously not the primary cause of death, and although coccidiosis can apparently co-exist and may in some cases possibly be an associated factor, many outbreaks fail to show any coccidia present. In view of the present limited state of our knowledge it is extremely difficult to offer advice, but we have found the following control measures to be effective. All progenitors of, and survivors from, affected litters should be immediately disposed of, or, if their condition is good, be isolated from healthy stock until they can be used for table. The usual precaution should be taken regarding cleansing and disinfection as described for coccidiosis. When importing new stock it is advisable to ascertain that there is no history of losses in the litters from which they were derived. As a further precaution, new breeding stock can be isolated until the first litter from each imported doe has been weaned for at least one month.

C.—The next group of diseases we have to deal with are those caused by fungi, and here only two conditions need be considered, favus and ringworm.

(1) *Favus* is an infectious disease of the surface of the skin and hair caused by the fungus *Achorian schonleini*. It is usually seen in young rabbits, and the parasite causes a similar disease in man, the cat, and possibly in dogs—an important point to be remembered in the control.

The diseased areas are most commonly found on the limbs, head and ears, although in severe cases it may extend to other parts. There is at first an accumulation of material composed of dead skin cells and debris, of a brownish-yellow colour, which gradually turns grey. The areas vary in size from pin's head to the size of a shilling. There is often a little tuft of hair left in the centre, and the edges are elevated. When the scab is raised the underlying surface is red and weeping. General health is not usually affected.

Treatment. Isolate affected animals and disinfect the hutch and utensils, and burn all litter. Scabs should be removed with a blunt knife, and collected and burned. The underlying surface should then be swabbed daily with tincture of iodine. As the disease is communicable to man, the operator must wear washable gloves when handling affected rabbits.

(2) *Ringworm.* Although the disease has been recorded in the rabbit, the exact species of the fungus Trichophyton has not been settled. Round, or oval, hairless areas, are found in any situation, and fanciers refer to the disease as baldspots. The general principles of treatment and prevention are as for favus.

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D.—*Metazoan Parasites*

(1) *External* and
(2) *Internal parasites.*

(1) *The external parasites.* These include mites, fleas and lice, and by far the most important of these are the mange mites.

Mange. There are two varieties of mange in the rabbit: ear mange, referred to by breeders as ear canker, and body or skin mange. The ear mange mites live among the scabs and crusts which they produce as a result of pricking the superficial layers of the ears, whereas skin mites burrow under the skin, and are more difficult to reach with medicinal applications.

Ear mange. There are two forms of ear mange, one caused by *Psoroptes communis cuniculi* and the other by *Chorioptes cuniculi,* and both are closely related to mites occurring in other domesticated animals. The symptoms of both these types of ear mange are similar, although chorioptic mange is usually less severe.

Symptoms. The mites produce an intense irritation, and a catarrhal condition of the external ear; the discharge is brownish in colour and with a fœtid odour. The inside of the ear becomes caked with the discharge, and subsequent bacterial invasion produces ulceration. Occasionally the parasites penetrate to the middle and inner ear, and nervous symptoms occur. Shaking of the head is common, and affected rabbits flap their ears and scratch violently with their hind legs. The head may be held in an oblique position. The disease is contagious and runs a long course, sometimes of months, and loss of condition ensues.

Treatment is similar to that for ear mange in the dog and must be accompanied by isolation of affected animals and disinfection of hutches.

Skin mange. Similarly there are two types of skin mange, sarcoptic mange and notœdric mange, caused by two different species of mite. Again they are closely related, and produce the same symptoms and lesions. The mites burrow deep in the skin and when the disease is suspected the skin should be scraped with the edge of a knife until blood is drawn, and the scrapings sent to a veterinary surgeon for diagnosis. Successful treatment depends on early diagnosis.

Symptoms. As the mites burrow under the skin an exudate is formed, and this dried-up exudate, plus skin debris, produces the characteristic scab. The irritation produces constant itching, and the animal scratching the affected parts causes open sores. These lesions usually first occur on the nose, lips, chin and forehead, and may spread to other parts. The fur drops off, and leaves greyish-yellow crusts. The disease is very contagious, and if not checked will spread rapidly, and kill affected animals within a few weeks. In the last stages of the disease the animals refuse food, and die from emaciation and exhaustion.

Treatment. Unless valuable animals are involved, it is not advisable to undertake treatment—owing to the rapidity with which the disease spreads. Affected animals should be killed and burned, hutches disinfected with hot coal-tar solution, and litter burned. Animals in adjoining hutches should be isolated and closely watched for early symptoms, and it is also advisable to

disinfect their hutches and burn the litter. Treatment of valuable animals may be carried out as in the dog, but isolation must be rigorous.

Fleas and lice are not apparently common in rabbits, and occur mostly in undernourished, weak animals, kept under unhygienic conditions. They produce great irritation and cause affected animals to rub, scratch, and bite themselves. The fur become ragged, and the skin shows red patches. The constant irritation may cause loss of condition. In both cases, dusting with pyrethrum powder, powdered naphthalene or derris root is effective. The powder should be allowed to remain on the coat for one-half to one hour before being brushed off, and the stupified parasites collected on a newspaper and burned. Houses must be scrubbed out with hot coal-tar disinfectant solution and all bedding burned. Attention should be paid to general hygiene, as all these parasites will multiply with greater rapidity in warm, dark, dirty and badly ventilated houses.

(2) *Internal parasites.* There are two types of internal parasites in the rabbit: tapeworms and roundworms. Tapeworms occur as the adult forms in the intestinal tract, while the larval stages known as cysts, or bladder worms, are found in various locations outside the alimentary tract. Roundworms occur in the intestines and stomach, and very occasionally in the lungs. As in poultry, a few worms can be found in most specimens arriving for post-mortem, but they would only appear to be harmful when present in large numbers. Heavy infestations in the rabbits are apparently comparatively rare. In large numbers they produce the usual unthriftiness, lack of appetite, and diarrhœa, and in young animals, stunted growth. They probably predispose to other diseases by lowering vitality.

Tapeworms. There are several species of the adult tapeworm found in the intestines of rabbits, but we have not yet encounterd a heavy infestation. Little is known regarding treatment, but in America freshly ground areca nut mixed with the food is advised. The dose is 1/4 to 1 gram, depending on the size of the rabbit.

The larval or bladder worm stage of the tapeworm is very common in the rabbit. There are two forms: the single-headed bladder worm, *Cysticercus pisiformis,* and the many-headed bladder worm, *Cœnurus serialis.* The first occurs in the abdominal cavity, and is seen on post-mortem as numerous small, white, watery blebs on the liver, and adhering in clusters to the intestinal wall and mesentery. It is doubtful whether they are harmful. The second form occurs in the tissues between the muscles and under the skin, usually in the region of the neck, face, shoulder and back. They range in size from minute pea-like cysts to the size of an apple. They may interfere with movement, and cause distortion of the part. Treatment, which would only be carried out on valuable animals, requires the surgical removal of the whole cyst.

Both types are the larval forms of adult tapeworms of the dog, and rabbits become infested as a result of swallowing food, etc., contaminated by dog's fæces containing tapeworms' eggs. Dogs, in turn, acquire adult worm infestation by eating the flesh of infected rabbits. Control measures, therefore, consist in excluding stray dogs from premises where rabbits and rabbit food are kept, and ensuring that dogs on the premises are kept free of tapeworms. Dogs should not be allowed to eat uncooked rabbit flesh.

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Roundworms in rabbits do not appear to be of much importance, and we have not observed a serious infestation.

The stomach worm is about ½-inch long and pinkish in colour. It is rare in housed rabbits, but said to be common in the wild species. It causes erosions of the lining of the stomach, and may cause perforation. In America, treatment is carried out by dosing with tetrachlorethylene in capsules, in a dose of 0.5 c.c. per kilo body weight.

The intestinal worms are whitish in colour and thread-like, and are about ½-inch long. In large numbers they cause enteritis and diarrhœa. The life cycle is direct; that is, the eggs pass out with the droppings and the rabbit can reinfect itself by swallowing contaminated food, etc. Treatment has been carried out by oil of chenapodium in capsule form in a dose of 0.15 c.c. per kilo body weight, followed by 10 c.c. castor oil. The main control, however, is by improved hygiene and housing. The lung worm is very rare and does not warrant description.

Non-specific Diseases

The commonest non-specific diseases of the rabbit are those associated with errors in feeding, such as diarrhœa, pot-belly and constipation. The first two are usually caused by feeding an excess of greenstuffs, mostly hay, decaying food or foul water. Damp insanitary hutches predispose to these conditions, while both may occur as symptoms of coccidiosis. Constipation, on the other hand, is usually due to excess of dry foods, lack of water or green food, or overfeeding, and may also accompany colds. Woolballs are frequently met with, particularly in angoras.

Another fairly common condition is sore hocks, and this is usually associated with close confinement under insanitary conditions. The hocks become swollen, inflamed and may ulcerate. The condition responds readily to treatment by cleansing and dressing with medicated dusting powders, when the animal has been moved to fresh quarters with dry, clean bedding. Pneumonia and mammitis are also fairly common in the rabbit, the former usually proving fatal in two to four days.

From the foregoing account of the infectious and parasitic diseases of rabbits it will be seen that, if attention is paid to sanitation and hygiene, the chances of these diseases spreading are greatly reduced. Hutches should be kept in a dry, light, well-ventilated and clean condition. Damp, ill-kept hutches, full of manure, which is kept moist by urine, constitutes ideal conditions for the sporulation of coccidial oocysts and worm eggs, and the multiplication of bacteria.

Hutches, therefore, should if possible be of such construction as to allow fæcal pellets and urine to drop through the bottom into a tray, which should be emptied daily, and frequently scrubbed with hot water and washing soda solution. Manure should never be dumped near the rabbitry and should be burned or ploughed in. Under no circumstances should rabbit manure be used on ground where rabbit food is grown.

Food and water containers should be of metal or earthenware, and should be scalded daily. They should be placed above the floor level, and only clean water should be given. All loose litter should be removed two or three times

per week and preferably burned. During an outbreak of disease even more rigorous disinfection is required. Secondhand hutches and utensils must be disinfected before use, and newly purchased stock should be kept in strict isolation for at least two weeks before being mixed with home stock. Quarantine hutches should be available on large rabbitries, where sick animals can be isolated until a diagnosis is obtained.

Special precautions should be taken in cleaning and disinfecting hutches in which pregnant does are placed, as young stock are more susceptible to infectious diseases than adults. Young stock should be weaned as soon as possible, and kept well separated from mature animals. Care must be taken that no litter from hutches in which adults are kept is introduced into hutches containing young rabbits, and overcrowding should be avoided.

THE INFLUENCE OF WAR ON CERTAIN PIG DISEASES

By D. J. ANTHONY

In view of the marked changes which have taken place in relation to the health of pig herds during these war years, and as the conditions prevailing in the herd discussed here are fairly typical throughout the country, I have thought it advisable to chronicle some experiences relating to the veterinary supervision of a large herd of pigs and to show especially how war has affected pig health in particular.

In pre-war years the herd in question comprised some hundreds of pigs of all ages, and was subdivided into: (a) the breeding sows and boars, kept in compounds, (b) sows with litters housed in a Scandinavian type of farrowing house, and (c) fattening pigs in a similar type of fattening house. Some pasture land was available for the breeding sows, and all pregnant sows were brought into the farrowing house a few days before parturition. The little pigs, after birth, were kept permanently indoors, except that a small opening in each farrowing pen allowed them access to a tiny covered "yard," about 3 feet wide by 10 feet long. The yard floor was bare earth, and the hinged roof could be opened during fine weather. Walls about 2½ to 3 feet high surrounded these yards, and in appearance they were not unlike cucumber frames, except for the lack of glass. Each farrowing pen opened into such a yard, the opening being like that found in a small dog kennel. The underlying idea, as for all Scandinavian type of pig houses, was the conservation of the pig's energy for fattening.

At the age of six or seven weeks, the little pigs were weaned, and moved into a large corrugated iron barn, with an ample supply of straw on the floor. Here some hundreds of newly weaned pigs would be housed for about four to six weeks. By means of creep feeds the youngsters were encouraged to eat some dry food, whilst still with their mothers. From this barn the pigs were drafted into the fattening house, where they remained until ready for slaughter as bacon pigs. Here the pigs would be weighed every week, and their food strictly rationed on the commercial basis of "so much meal produces so many pounds of bacon."

The pigs were thus under constant supervision, and records were kept of all farrowing, sizes of litters, feeding, gains in weight, etc., and all done with a

view to getting the pig to bacon weight at the earliest possible time and with the least expense. The whole system, from pregnancy to slaughter, was very "scientific." Agricultural papers in pre-war years were full of accounts of this "scientific breeding" and "scientific feeding" of pigs. Experiments and general practice in the United States of America were constantly being boosted as examples to follow, irrespective of the difference between our breeds of pigs and the American "lard hog," or of the amount of land and type of feeding available.

It was of course inevitable, that to ignore completely Mother Nature by depriving young stock of fresh air, sunlight, green pastures and freedom of movement, was only inviting trouble. It was inevitable and came in full measure. "Much wants more" is a good old saying, and here was no exception. More breeding sows, more young stock, and fattening houses full to overflowing was the aim. The result was overstocking "pig-sick" land, with no fresh pastures available for rotation and resting of the old land. As night follows day, this was followed by deficiency diseases, small litters, birth of dead pigs, abortions, scour, anæmia, influenza, paratyphoid, pneumonia, swine erysipelas, and culminating in swine fever.

From the veterinary point of view, this was a period of constant dispensing of medicines, injections of sera and vaccines, post-mortem examinations, the tendering of advice, and appeals for a more common-sense method of rearing the young stock. Eventually it was agreed as an experiment and with great reluctance to allow the sow and litter access to pasture land during fine weather for certain periods daily, and not to confine them exclusively to the farrowing house. The usual anæmia treatment had already been tried on these young pigs. This consisted of painting the udder with iron and copper compounds, throwing in earth clods and green fodder, etc. All this caused some slight improvement, but when the modified "open air" system was adopted and the sow allowed out with the young pigs for a period daily, the improvement in the health of the youngsters was most marked. However, the land was so pig-sick that paratyphoid, or necrotic enteritis and the other accompanying "environmental" conditions were still present despite all treatment.

At this time much information was being gathered about swine influenza virus, and causal organisms of paratyphoid, all of which had not the slightest effect upon the incidence of the diseases in question. This makes one wonder when bacteriologists will cease talking of causal organisms and begin to realise that neither a virus or bacterium is a primary cause of disease, but is merely secondary to some environmental condition.

Fortunately, an outbreak of swine fever gave a temporary respite to the overstocking. This outbreak came as a sort of final judgment on the whole crazy system. The clearing out of many head of stock enabled the land to be ploughed up. A marked improvement in the health of the herd followed the re-stocking, with the abandonment of mass farrowing in a Scandinavian type of pig-house in favour of small huts in grass compounds. The addition of milk to an already good ration had rendered annual vaccination of the fat stock against erysipelas unnecessary, whilst an improvement in the ventilation of the fattening house reduced the incidence of pneumonia therein to a stage when it could be controlled by the use of M & B 693. In spite of all this, the tendency to overstock remained,

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and soon became an obsession with a change of herd ownership and control, so that the crops of deficiency diseases and conditions already mentioned began to increase once more. That stage had been reached when war came in 1939.

The cutting down of imported pig foods, rationing of feeding stuffs in general, and difficulty of labour, soon brought a change over pig rearing *en masse*. A "back to nature" movement set in, and pigs were weaned at an older age, also they were not sent into the fattening houses until much older than had been the pre-war custom. Pigs were allowed more freedom to "scrounge" some of their own food, the number of breeding sows in the herd was drastically reduced. As a result, more land was available for resting in rotation. Pigs took a much longer time to arrive at the slaughter age; in other words, the "mass production" period was ended, and a more natural system adopted in its stead, resulting in a remarkable change in the health of the herd. Anæmia, scour, swine influenza, avitaminosis, are now almost unknown, and to this list I ought to add paratyphoid. Swine erysipelas may still be encountered in the fattening stock occasionally, now milk is no longer available for feeding to pigs, but, speaking generally, there has been a great change for the better, so that, instead of treating animals as a herd, one now has individual cases only.

Whether commercial greed will compel a return to the old "intensive" system after the war remains to be seen, but there can be no doubt of the beneficial effects of the war-time system upon the health of pig herds, and if there is a lesson to be learnt from all this, one such is that too much time can be devoted to enquiring into bacteriological "causes," whilst environmental conditions are either ignored or passed over as of lesser importance.

Abstracts

THE OCCURRENCE OF UNCOMPLICATED COBALT DEFICIENCY OF SHEEP IN SOUTH AUSTRALIA*

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Introduction

In South Australia, Marston *et al.* (1938) showed that "coast disease" of sheep was caused by a dietary deficiency of cobalt and copper. More recently, workers at the Animal Nutrition Laboratory (Anon., 1941) found that copper deficiency in sheep existed in many areas in the southern part of the State and they expressed the view that some of these areas might also be deficient in cobalt. The experiments recorded here show that, at least on one soil type, a simple cobalt deficiency in sheep may occur, apparently uncomplicated by deficiency of copper. This work arose from an investigation of a serious outbreak of a wasting disease.

No serious trouble had been experienced with the flocks until 1938. In that year the lambs failed to thrive, about 30 per cent. died and the survivors made very poor growth. In 1939 the lambs at first made good growth, but soon signs

* Abstracted from *The Australian Veterinary Journal*, June, 1942.

of unthriftiness appeared: this progressed to emaciation with fatal termination. Only a small percentage of the lambs survived. Later in the season the disease extended to the adult sheep, which showed the same symptoms with high mortality rate.

Symptoms.—The symptoms exhibited by seriously affected animals were rather characterless. There was progressive emaciation and the sheep became listless, lethargic, extremely weak and easily fatigued on exercise. The wool was tender or "broken." In some cases there was excessive lachrymation and the dried exudate matted the wool below the eyes. In most, but not all, cases there was pallor of the skin and visible mucosæ, indicating a probable anæmia. in a few cases there was diarrhœa.

At autopsy no characteristic abnormality was observed. The skin was thin and fragile and the body devoid of fat, which had been replaced in the fat depots by a pale yellow, semi-fluid, gelatinous substance. Excess of clear, colourless fluid was present in the peritoneal cavity and pericardium and sometimes in the pleural cavity. There was obvious wasting of the musculature and visceral glands; the spleen was small and firm with scanty pulp; the bones were usually thin and fragile.

The post-mortem findings differed in no essential respect from cachexia due to starvation or malnutrition.

Experiments and Results

Experiment 1.—Sixteen lambs, which were seriously affected, were weighed, matched in pairs on body weight and general condition and one of each pair was selected by random sampling for each of two experimental groups. The control group received no treatment, whereas the treated group received three times weekly a mineral supplement as a drench. This was calculated to give approximately the equivalent of the following daily doses: cobalt 1 mg., copper 10 mg., zinc 1 mg., manganese 2 mg. and iron 12 mg. Pure salts were used and precipitation of the iron was prevented by addition of citric and sulphuric acids. All the sheep were run on the same pasture and, to reduce parasitism, all were drenched regularly with a mixture of copper sulphate and nicotine sulphate.

Within eight weeks, four of the control sheep had died, whereas the remainder had lost weight. None of the treated animals had died and all had increased in weight. After the eighth week both groups showed a steady increase in body weight, although the treated sheep made slightly more rapid growth than the controls. Throughout the experiment the clinical improvement of the treated sheep was evident, they were more robust in appearance, brighter, more alert and active.

Experiment 2.—The evidence pointed to a deficiency of cobalt being the chief factor and this hypothesis was tested on two groups of 11 sheep each. All the sheep showed signs of wasting. The controls received no treatment, but the sheep of the treated group were drenched three times weekly with a solution of pure cobalt sulphate giving doses equivalent to 1 mg. cobalt per day. Both groups made satisfactory gains in body weight and returned to normal health. There was no difference in the rate of growth of the two groups.

Experiment 3.—In view of the results in the second experiment with a cobalt supplement, it was decided to repeat the first experiment on the next

season's lambs. Numerous post-mortem examinations had shown that, during the later part of the summer, infestation with internal parasites had increased. To avoid the possible complication of the experiment from this cause, the treatment of the groups was arranged as follows:

Group 1. Mineral supplement plus anthelmintic treatment.
„ 2. Mineral supplement only.
„ 3. Anthelmintic treatment only.
„ 4. Control—no treatment.

The lambs were divided into matched groups of four, based on sex, weight and age, and by random sampling the four lambs were then distributed between the four experimental groups. Each group contained 11 lambs. Groups 1 and 2 received three times weekly a drench calculated to give the equivalent per day of cobalt 1 mg., copper 10 mg., zinc 1 mg., manganese 2 mg. and iron 15 mg. Groups 1 and 3 were treated at intervals of three weeks with a mixture of copper sulphate and nicotine sulphate. All the lambs were run on the same pasture and were weighed weekly.

As in the case of experiment 1, the superiority in general appearance of the lambs in the two groups receiving the mineral supplement was more pronounced than was indicated by the difference in body weights.

Experiment 4.—Under the unusual seasonal conditions which prevailed during the course of experiment 3, the results were considered sufficiently encouraging to proceed to a repetition of experiment 2, that is to test the effect of a simple cobalt supplement.

Forty-six pregnant ewes of even type were ear-tagged and weighed, and on the basis of body weight were distributed by random sampling into two groups. The control group received no treatment, whereas the treated group received, by drenching, weekly doses of a solution of pure cobalt sulphate, equivalent to a daily dose of 1 mg. of cobalt. The first drench was given two months before lambing was due to commence and drenching was continued until two weeks before lambing. The lambs born from treated ewes were drenched weekly with the same solution and dose as their mothers and the drenching of the ewes was continued until weaning. The lambs from the control group of ewes received no treatment. The failure of the control lambs to develop the "wasting" disease prejudiced the obtaining of unequivocal results. The lambs of the treated group were slightly heavier than the control lambs when treatment was commenced, and the rate of growth during the later part of the experiment was definitely greater.

It was again noted that the treated animals appeared brighter, livelier and more robust than the controls.

These experiments have shown that sheep seriously affected with a "wasting" disease were rapidly restored to health by administration of a complex mineral mixture containing cobalt, copper, zinc, manganese and iron. In subsequent years on the same property the use of a similar mixture and also of a simple cobalt supplement resulted in improved growth and general vigour of young sheep.

In ruminants, disease due to dietary deficiency of cobalt has been observed in several countries. In Australasia, cobalt deficiency, apparently uncomplicated by

deficiency of copper, has been recorded in Western Australia (enzootic marasmus —Underwood and Beck, 1941) and in New Zealand ("bush-sickness"—Askew, 1939). The present investigations show that the same disease occurs in sheep in South Australia.

Several reports of "wasting" in sheep have been received from properties situated on this soil type and, although no experimental investigations have been conducted, successful results have been obtained in practice by allowing the sheep access to salt licks containing cobalt and copper. As copper deficiency in sheep is so widespread in South Australia (*loc. cit.*), it is possible that some at least of these areas may be low in copper as well as in cobalt.

Summary

1. Evidence of the occurrence of a simple dietary deficiency of cobalt in sheep in South Australia is presented. There is no evidence that deficiency of copper is involved.

2. The area on which the disease was studied is of a uniform and distinct soil type, the nature and distribution of which are recorded.

3. The extreme seasonal variation in the incidence of the disease has shown clearly the importance of incipient or mild states of deficiency, which under special seasonal or other conditions may be enhanced to a frank deficiency resulting in very severe losses.

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EQUINE ENCEPHALOMYELITIS*

By RAYMOND RANDALL

THIS article is an excellent summary of equine encephalitis in the U.S.A. While the disease does not occur in this country, it is important that veterinary surgeons here be acquainted with its salient features. The following is an abstract of the paper with full quotations in some places.

Epizootic diseases of horses and mules manifested by disturbance of the central nervous system have been known in parts of the U.S.A. for the last sixty years and have been referred to under such names as cerebro-spinal meningitis, blind staggers, Kansas-Nebraska horse plague, sleeping sickness, forage poisoning and botulism. A history of the recovery of a filterable virus by Meyer and his colleagues in affected animals and an account of the incidence and spread of the disease are given. Two different strains of virus have been isolated—the "Eastern" and "Western" strains, which, though causing diseases of much similarity, are different immunologically. A third type of equine encephalomyelitis virus, immunologically different from the other two, has been recovered in Venezuela. "For the past few years encephalomyelitis has been the

* *The Army Veterinary Bulletin.* 1942. *XXXVI,* 157.

most important equine disease in the United States. Several workers have reported infection of human beings, and in some cases the virus was recovered from the patient, while, in others, the serum of the convalescent person was shown to contain antibodies which neutralised the encephalomyelitis virus. In most cases of human infection the infected persons had contact with horses—in some cases with sick horses.

" Prior to 1932, nothing definite was known about the transmission of equine encephalomyelitis. The general belief was that infection was carried by food or water contaminated by infected animals. It had been observed that the disease appears in early summer, reaches its peak late in August or September, and disappears with the coming of killing frosts. Infection follows natural water-courses and irrigation systems, and appears simultaneously at widely separated points. Its greatest prevalence is in rural areas among horses kept at pasture at night. The epidemiological findings are against its transmission by contact and favour the view that it is insect borne." It has now been shown that the virus can be transmitted by different species of mosquito: the tick, *Dermacentor andersoni,* and the bug, *Triatoma sanguisuga,* may also transmit the virus.

" The reservoir of the encephalomyelitis virus is unknown." " The horse does not seem to be a suitable reservoir, since the virus can by isolated from its bloodstream only during the early stages of the disease and a chronic carrier state has not been established. Pheasants, pigeons and prairie chickens have been found infected under natural conditions." The demonstration of neutralising antibodies in the serum of many mammals and birds indicate a wide host range of the virus and as mosquitoes feed readily on mammals and birds, this finding strengthens the view of mosquito vectors of the disease."

Two quite different types of clinical cases are commonly found: " the sleepy type, which drowses until disturbed, when it frequently becomes convulsive; and the walking type, which continues to pace round and round. In a field, such cases usually follow close to the fence and only change direction when they are in contact with an obstacle or a turn in the fence. When undisturbed, some stand with the head against a wall or fence." Both these types " show high fever, cessation of peristalsis, lip droop, muscular twitching and even dysphagia, but do not exhibit any serious disturbance of motility. Prognosis is usually favourable in this type. The paralytic stage is a further progression of the malady." " The apoplectic or bulbar type has a rapid course, the animal usually collapses after a short period of inco-ordination, along with cardiac and respiratory distress, followed by death in six to twelve hours. The violent or excited type exhibits impaired vision, which causes stumbling, and the animal may break through fences or run into objects which, in turn, further excites the animal."

The following is the author's description of clinical symptoms: " The usual course of the disease in the horse consists of three stages. In the first or incipient stage the animal appears to be depressed. This stage is generally accompanied by high fever of 104 to 107 degrees Fahr. It is in this stage that the virus is present in the peripheral bloodstream. The second stage usually follows in 18 to 24 hours and the temperature drops to 101 to 103 degrees Fahr. It is in this stage that disturbances of motility, such as paresis and inco-ordination, begin to appear. One or both lips may droop, accompanied by twitching of the facial

muscles. There is little desire for food or drink, or there may be inability to swallow food or drink. A very marked decrease in weight occurs within 24 hours. There may be impairment of vision and the animal walks with a weaving gait, and later may brace himself against a fence or building. Yawning, chewing movements, increased salivation and grinding of teeth are almost constant. The third stage is that of prostration, when the subject collapses and is no longer able to get up. At this stage the animal usually struggles violently. Clonic spasms of a few seconds' duration may occur at irregular intervals, particularly upon handling. Peristalsis and bowel evacuations are suppressed. Inhalation pneumonia is a frequent complication. The prognosis is most unfavourable when the prostration stage is reached, although a few subjects recover with careful nursing, but the motor functions are usually permanently impaired, making the animal in many instances useless as a work animal."

Concerning the pathology of the disease, which is similar in man, there is found œdema and congestion of the brain and spinal cord, with flattening of the convolutions and the presence of pressure cones in the cerebellum. The liver is enlarged and membranes and body tissues are usually icteric. Broncho-pneumonia is the rule. Microscopic examination shows "varying degrees of degenerative changes in the nerve cells, characteristic infiltration with polymorphonuclear leucocytes causing a cuffing effect about the blood vessels. Many small thrombi are present in the blood vessels and in other organs of the body. The picture is a diffuse meningo-encephalitis."

Concerning diagnosis, it is stated that the disease has been repeatedly confused with other forms of encephalitis. When similar cases appear "in widely separated areas without any food connection," they should be regarded with suspicion, especially among horses at pasture and in the summer months. The author says that a thorough clinical study of the case should be made and, in addition, "portions of the brain should be obtained from an animal which has recently died, or has been recently destroyed, in the advanced stages of the disease." The brain material is used for guinea-pig inoculation—intracerebrally, control and immunised guinea-pigs being used. Complement fixing antibodies appear to be transitory while neutralising antibodies remain for some months.

As far as treatment is concerned, it is stated that the use of virucidal serum "is usually disappointing, though it is of excellent value in outbreaks when given to animals not yet showing symptoms, or those in the early stages of the disease. But after visible signs of infection are apparent, such as paralysis, the inflammatory reactions and destructive changes to the central nervous system are such that serum treatment is futile. This is due to the fact that viruses multiply and carry on their activity within susceptible body cells and cannot be attacked by humoral antibodies while within such cells." Physiological saline solution fortified with glucose given intravenously is indicated; medicinal treatment is largely symptomatic. Good nursing is essential.

The author deals with prophylaxis at length and gives an account of the various methods adopted for the induction of active immunity, varying from the use of subcutaneous injections of brain suspension, formalinised vaccine prepared from brains of horses killed in the advanced stages of the disease to vaccine prepared from developing chick embryos, injected intradermally. In

1941, for example, approximately 50,000 horses and mules in the Army were vaccinated with the latter type of vaccine. The use of vaccine has been followed by excellent results. It is stated that, " among all of the immunised army animals during the years 1939, 1940 and 1941, there were, with one exception, no cases of equine encephalomyelitis." The exception was an animal " which had been previously immunised against the Western type virus and which developed the Eastern type disease . . . before immunity against the Eastern type virus was affected by revaccination of the animals against this type of disease." All army animals are now being immunised against both Eastern and Western types of virus with a bivalent vaccine.

Attention is also drawn to reports of untoward and serious reactions following the use of chick tissue vaccine. But, " so far, the army has experienced only a few reactions of any consequence." This is accounted for by the fact that only fresh vaccine is used and great care is taken in its administration.

Throughout the article references are made to the disease in the human subject.

The author states the following conclusions: It is apparent that the name equine encephalomyelitis is a misnomer. While encephalitis is the most important horse disease in the United States at present, the disease is assuming importance from a public health standpoint, due to the definite knowledge that the human family is readily susceptible to the viruses with a relatively high mortality rate. The evidence is ample to indicate that the disease is transmissible through the agency of insects, particularly mosquitoes. Its control involves anti-mosquito measures. Fortunately, it is possible to vaccinate horses and mules, and its control in them can be satisfactorily accomplished by the annual use of chick tissue vaccines. Although many human cases occurred last year, it is considered that the epidemic was not on a large enough scale to warrant general vaccination in man. Consideration should and is being given to the preparation of a vaccine adapted especially for human use if conditions should occur to warrant its use.

STUDIES IN FERTILITY IN SHEEP*
SEMINAL CHANGES AFFECTING FERTILITY IN RAMS

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Seasonal Changes

ATTENTION was directed to the effects of seasons on semen production in the casual examinations of samples collected by our electrical method (Gunn, 1936) in some of the hotter parts of New South Wales. Since the changes appeared to be similar to those produced in rams in which we had caused seminal degeneration by scrotal insulation, the effects of hot, dry atmospheres were investigated. In a well-insulated room in which we could control the temperature and humidity, we attempted to reproduce the hot, dry atmospheric conditions typical of much of western New South Wales in the summer. In this chamber we placed known normal rams for varying periods and subjected a number of them to atmospheric

* Abstracted from *The Australian Veterinary Journal*, June, 1942.

conditions closely resembling those prevailing in summer in western New South Wales. These experimental conditions resulted in seminal degeneration of a similar nature to that already observed in certain hotter districts of the State.

Geographical Survey of Rams' Semen.—On well-managed estates situated in districts lying between Bathurst and Bourke, and thus including cold to very hot areas, we examined on each property the semen of a dozen or more, clinically normal, two-year old merino rams at quarterly intervals. Half of the rams on each station were service rams, and half were unmated. All semen samples were collected by our electrical method and examined for motility, longevity, number of spermatozoa, reaction and morphology.

In the hotter districts seasonal changes were very marked and corresponded closely to seasonal heat, most marked degeneration being found in summer and most normal semen in winter. This occurred despite the fact that natural feed was plentiful.

Even in the cooler districts changes in some of the characters indicated a definite relationship between semen production and the seasons.

The survey was later extended to rams on other properties and was carried over a number of years. The seasonal changes in the seminal characters were found to vary according to the atmospheric temperatures, hot weather inducing seminal degeneration and cooler seasons favouring recovery. In the absence of extremes of heat the changes were minimal.

Though observations were mainly carried out on merinos, the same changes were found to occur in rams of British breeds. Obviously a reliable guide to a ram's future fertility cannot be obtained unless the examination of the semen has been made at the ideal season.

Changes Caused by Fever

Blow-fly Strike and Other Conditions.—As blow-fly strike in sheep is often accompanied by a rise in body temperature, and as the semen of fly-struck rams was found not to conform to the standard of the average of rams, we investigated the effect of artificial blow-fly strike on spermatogenesis in merino rams.

We found that blow-fly strikes produce degrees of seminal degeneration varying from mild to very marked according to the depth, extent and duration of the strike. More marked seminal degeneration followed strikes on the scrotum than elsewhere.

We have also found that footrot, extensive infected wounds and acute abscesses produce similar results.

We suggest that the poorer semen which we have frequently observed in rams at the termination of a service season is in part related to the rise in body temperature which we have found results even in winter from sexual excitement and service. Such might be expected to be still more marked the warmer the season at which the rams were mated.

Changes Caused by Arsenic

In rams dipped in arsenical fluids while carrying full fleeces and half fleeces, seminal degeneration occurred to a degree varying mainly with the length of the fleece and the rapidity of drying; scalding of the skin of the scrotum occurred

in a few. In the recently shorn rams dipped in arsenical fluids seminal degeneration was the least marked, and scalding of the skin of the scrotum was rare.

To make sure that the seminal degeneration which followed dipping resulted from absorption of arsenic through the skin and was not caused by scalding or other local irritation of the scrotum, we dipped in arsenical dip certain rams whose hindquarters and scrota had been previously shorn and then immediately washed the dip from the hind parts of the body with water. We also injected sodium arsenite intravenously three times a day for four successive days into other rams in doses of 20 or 30 mg. in an attempt to simulate what we visualised as slow absorption into the body of arsenic after dipping. In all these rams seminal degeneration developed to an extent equivalent to that which had occurred in the rams dipped ordinarily.

Analysis of urine and fæces showed that the dipped and injected rams excreted arsenic in amounts comparable to the respective degree of seminal degeneration shown. The amounts of arsenic recovered from dipped rams were approximately equal to those recovered from injected rams and more than ten times as much as from untreated rams and from rams dipped in water.

We have demonstrated that, after dipping in arsenical dips (containing even less than the usually recommended 0.2 per cent. of As_2O_3), rams may absorb through the intact skin comparatively large amounts of arsenic, sufficient to cause seminal degeneration. Seminal degeneration is more marked the longer the fleece and the hotter and more humid the weather prevailing at and after the time of dipping. In our opinion, therefore, dipping rams carrying considerable length of fleece in arsenical dips should be avoided, and cool, dry, preferably windy weather should be selected for dipping even short fleeced rams in order to ensure rapid drying and hence minimum absorption. We consider that rams with long fleeces should not be dipped in arsenical dips during the two months prior to mating.

Changes Caused by Deficient Nutrition

During drought periods we had observed degrees of seminal degeneration in apparently normal rams at times of the year not corresponding to seasonal heat, and in our surveys in parts of Queensland we had found that the semen of rams kept on natural pastures even in good years was degenerated not only at periods corresponding to the intense heat of summer as in New South Wales, but also during late winter and in spring.

Degeneration of the semen of all the rams kept on experimental diets occurred within two and a half to four and a half months, even when their body weights remained relatively constant. In those in which considerable losses in body weight occurred seminal degeneration was the more rapid. Night blindness occurred in all the rams with degenerated semen; in most it was observed shortly before signs of seminal degeneration became evident.

It appeared that vitamin A or its precursor, carotene, was a common deficiency in all of our diets which caused seminal degeneration and that the addition of either of them resulted in recovery.

An observation of considerable scientific interest but of little practical value was that the administration of the gonadotropic hormone of pregnant mares'

serum to rams suffering from seminal degeneration caused by diet deficiencies, resulted in rapid return of the semen to normal, whether the body weights increased or not. In practice, of course, the correction of the diet is easier and preferable to the administration of the hormone.

Changes Caused by Clinical Abnormalities in the Genitalia

In the examination of over 9,000 rams—over 6,000 in Queensland and 3,000 in New South Wales—we have found the frequence of occurrence of the various abnormalities very similar in the two States, though varying widely on different properties. The following table shows the incidence of the more common conditions:

Clinical Abnormalities in Rams' Genitalia

	Queensland	New South Wales
Hypoplasia or atrophy of the testis ...	3.5 per cent.	3.3 per cent.
Epididymitis and spermatocele ...	5.3 „	5.7 „
Varicocele	1.0 „	2.2 „
Cryptorchidism (unilateral)	0.3 „	0.7 „
Inguinal herniæ	0.2 „	0.2 „

We have been unable to relate the occurrence of these clinical abnormalities to any climatological, geographical or topographical features nor to the amount of timber present in the locality. We have found that the percentage of affected rams increases in the higher age groups except in regard to cryptorchidism.

Of the clinical abnormalities those associated with seminal degenerative changes are hypoplasia or atrophy, epididymitis with spermatocele and old-standing inguinal herniæ.

Semen Characters and Fertility

Observations on Relationship.—Our data, which are somewhat limited, have been obtained from the experimental matings of rams whose semen characters were observed before, during and after matings, and from stud and flock records kindly made available to us.

From the former we draw the following conclusions:

(1) The percentage fertility of semens in which degenerative changes are present is in inverse proportion to the degree of degeneration: the greater the degeneration, the less is the fertility.

(2) Semens containing up to 0.1 per cent. free heads may be highly fertile.

(3) Semens exhibiting signs of recovery from seminal degeneration, though still with morphological abnormalities, are more fertile than similar semens which are not changing or which are in a stage of progressive degeneration. *Vice versa,* semens showing signs of progressive degeneration, especially if they contain adventitious cells, are less fertile than similar semens which are stationary or in a stage of recovery.

(4) Extremely degenerated semens are entirely infertile.

We also have some evidence to indicate that in any given type of semen, the

larger the number of spermatozoa in it the higher is its fertility and *vice versa*.

We have found no sharp line of distinction between highly fertile and sterile rams, but rather a gradation through intermediate degrees of fertility from one to the other.

The fertility of sheep mated at different times throughout the year conforms to the seasonal seminal changes which we have found to occur and to result from seasonal heat and variations in available pasturage.

We have shown that degenerative effects are produced on the semen of rams by seasonal heat and by seasonal diet deficiencies, and that a close relationship exists between seminal characters and actual fertility. Therefore, we consider that it is possible to predict with some degree of accuracy the type of semen and consequently the likely average fertility of entirely pasture-fed rams at any given time, provided suitable local meteorological data are available.

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Abstracts of Current Literature

Enzootic Ataxia and Copper Deficiency of Sheep in Western Australia. By H. W. Bennetts and A. B. Beck. Commonwealth of Australia. Council for Scientific and Industrial Research, Melbourne. 1942. *Bulletin No.* 147.

Enzootic Ataxia in lambs is the name applied to the disease in Australia which, in this country, is referred to as "Swayback," and is one of the best known examples of the effects of a deficiency of a trace element in the diet: copper, in this case, is the element. Bennetts has already written on the subject and in this country the results of the researches of Innes and his colleagues have been published. The present article is a comprehensive survey of the condition in Australia and adds yet further knowledge on the subject. The author's summary is as follows:

Enzootic ataxia is a disease of the unweaned lamb characterised clinically by ataxia affecting the hind limbs, and pathologically by demyelination of the nervous system, a typical degeneration of the spinal cord being pathognomonic. Extensive brain lesions may occur in the more acute cases.

Enzootic ataxia is due to copper deficiency. It is prevented by the administration of copper supplements to the mother, and in the lamb the course of the disease is arrested by copper treatment.

A low copper status of the mothers (liver, blood and milk) and of the affected progeny (liver and blood) has been constantly demonstrated in all cases investigated.

Pasture analyses from a number of widely separated affected areas have shown a low copper status throughout. The distribution of the disease, moreover, coincides with that of other stock, cereal, and pasture problems known to be associated with copper deficiency.

Adult sheep maintained on affected properties show signs attributable to copper deficiency. These are " stringiness " of wool and, in breeding ewes, loss of physical condition and diarrhœa during the late gestation and the lactation periods; a severe anæmia is commonly exhibited concurrently. Copper supplements or a change to " healthy " country are curative.

Severe anæmia in ewes near to parturition is directly correlated with an acute form of ataxia in the progeny. Ataxia, however, may occur in the progeny of ewes that do not develop anæmia.

It has been demonstrated experimentally, and extensively under practical farming conditions, that the benefits of copper supplementation are not confined to the prevention of ataxia. Copper promotes optimal growth in lambs and has a marked beneficial effect on the adult members of the flock, anæmia and other signs of ill-health being absent in the breeding ewe and wool growth being normal throughout.

Copper supplements, under practical conditions, are administered in lick form or by top-dressing of pastures with copper compounds. It has been demonstrated that the copper status of mixed pastures may be raised to " normal " levels by this means. There is some evidence that top-dressing is the more beneficial. An investigation to determine the optimal rate of top-dressing and the period of effectiveness is now in progress.

The pathogenesis of enzootic ataxia has been discussed in some detail, but pending the results of fundamental studies of copper metabolism in the sheep and a more complete knowledge of the normal process of myelination in the lamb no really satisfactory explanation is possible.

Treating Pregnant Ewes with Phenothiazine. By R. T. HABERMANN, A. O. FOSTER and O. J. HUMMON. *North Amer. Vet.* 1942. *23*, 390.

THE authors point out the necessity for treating pregnant ewes against parasitism in order to prevent perpetuation between seasons in breeding stock. They worked with ewes in all stages of pregnancy and tested the drug on groups of animals. Each group was given a mixture consisting of 125 gm. phenothiazine, 200 c.c. molasses, 200 c.c. warm water and about eight pounds of a mixture of bran, oats and corn. The amount of phenothiazine worked out at 25 gm. per sheep. The mixture was prepared by mixing the phenothiazine and molasses into a thick paste and adding the water to make a syrupy suspension. The mixture was then thoroughly incorporated into the feed. The feed was given in the morning and no other food was given till it was consumed. To accustom the ewes to the taste of the molasses, the mixture without the drug was fed for a few days.

Seventy-seven healthy lambs were born to the 68 ewes treated in 1941 : 32 of

the lambs were dropped by 21 ewes that were treated within four weeks of parturition; two ewes had triplets. Two lambs from one ewe died at or near birth and two ewes had still-births, 36 and 67 days, respectively, after treatment: the authors do not consider the treatment as the cause of these deaths, for the incidence of early mortality in the group in 1941 was less than in previous years when phenothiazine was not used.

In 1942, 70 ewes of the same flock, most of which were in a late stage of pregnancy, were treated. No molasses were used in the mixture. No injurious effects were found.

The drug was also given to three pregnant ewes in capsule form in amounts of 25, 80 and 100 gm., respectively, and one ewe was given 15 gm. phenothiazine daily in the feed for 21 days prior to parturition. All gave birth to healthy, normal lambs.

Actinomycosis of the Dog and Cat. By H. M. MARTIN. *University of Pennsylvania Bulletin. Veterinary Extension Quarterly.* No. 87. 1942.

THE author describes three cases of actinomycosis in the dog—one subcutaneous, one in liver and lungs, and one involving the abdominal cavity. In all the cases the histological picture was chiefly that of granulation tissue with the occurrence of small abscesses in which rosette-like colonies were found having the characteristics of a typical *Actinomyces*, though some of the features of a typical *A. bovis* were absent, e.g., they lacked the typical club ends at the periphery.

A description of a case of actinomycosis in a cat is also recorded.

The conclusions are: The writer wishes to call attention to the fact that actinomycosis in dogs does not seem to be restricted to any one part of the body. This condition is usually chronic in nature but may terminate as a rapidly progressive and destructive disease. This malady may be more common in dogs than is usually suspected, because of the fact that it may be considered as being neoplastic rather than an infectious granuloma.

Urinary Calculi in Sheep. A short review of Relevant Literature. By W. I. B. BEVERIDGE. *Aust. Vet. J.* 1942. *18*, 127-132.

URINARY calculi cause considerable loss in Australia. Such losses occur in stud rams being prepared for show and sale. They also occur in wethers.

The calculi are found most commonly in the urethral process, just behind the segmoid bend or at the ischial arch.

The author reviews the various factors which have been listed as probable causes.

He concludes that available evidence suggests that vitamin A deficiency and unbalance of calcium, magnesium and phosphorus are probably the main operating factors. It is also possible that there are factors involved which are not yet recognised.

Contributory causes may be conditions leading to concentration of urine, such as dry concentrated feed rich in total minerals, hot dry climate and the drinking of water containing appreciable concentrations of magnesium, calcium or carbonates. As regards prevention: inclusion of lucerne hay in the diet

XUM

would correct any vitamin A deficiency, offset excess phosphorus in bran or grain by supplying calcium and also supply magnesium.

Lucerne hay increases the volume of urine excreted. As lucerne contains an excess of calcium over phosphorus the balance may be rectified by providing some grain or sodium phosphate. *Vice versa,* if excess of calcium is obtained by the grazing animal, this could be offset by supplying sodium phosphate in licks or in drinking water.

A readily accessible supply of palatable water should always be available to animals on concentrated diets.

The sheep's urine is alkaline on most diets. It is usually acid on a diet of cereal hay grain and meat meal Acidification of the urine should prevent calculus formation, since sheeps' calculi are usually deposited in alkaline urine and mostly consist of phosphates.

In his review the author quotes 18 references.

Two Cases of Myositis Caused by Sarcosporidia. By R. CLARK and CECIL JACKSON. *Jl. S.A.V.M.A.* 1942. *XIII* (1), 12-14.

Two cases are recorded, one in the pig and one in a horse. The cases are recorded because they showed focal necrotic centres with marked inflammatory reaction. The myocardium was affected in the pig and the masseter muscles in the horse. Excellent microphotographs are included. Inflammatory reactions have not previously been encountered in domestic animals in South Africa.

Brucellosis in a Pregnant Mare. By W. S. STONE. *Cornel Veterinarian.* Oct., 1941. *31,* 394.

THE author records the case of a pregnant mare that had fistulous withers. The mare was due to foal in a few weeks.

There had been contact with a herd of cattle known to be infected with Bang's disease. Pure cultures of Brucella abortus were obtained from the fluid extracted from the unopened fistula.

An apparently healthy foal was dropped. The mare's blood, the foal's blood and the mare's milk gave positive reactions to the agglutination test.

Cultures and biological tests of the milk and placenta were negative. The author concludes that the evidence gained in this case substantiates the belief that Brucella does not play an important role in equine abortion. It is possible for a pregnant mare to be infected in a local area and not cause abortion or lead to the elimination of Brucella in the fœtal tissues.

Acute Nicotine Poisoning in Cattle. By H. E. HORNBY and M. H. FRENCH. *Jl. S.A.V.M.A.* 1942. *XIII* (1), 21-25.

IN their search for a satisfactory tsetse-fly repellent the authors studied the effects of Nicotine Sulphate. It was found that the flies were not repelled by solutions of less than three per cent.

A series of five experiments were conducted upon oxen to test the toxicity of a weak solution when sprayed over the whole body of the ox.

Toxic symptoms were manifest shortly after application, death resulting in experiments Nos. 1, 2 and 5.

Symptoms shown: Nausea, sweating, salivation, greatly disturbed respiration and pulse, retraction of eyeballs; clonic spasms; inco-ordination; coma, death.

Lesions: Cyanosis, retraction of eyeballs, engorgement of subcutaneous and splanchnic vessels; poor clotting of blood; flabby, empty heart; contraction of spleen; lack of tone throughout the alimentary tract.

The authors consider that these experiments show that absorption can take place through the whole skin.

In this country nicotine has been used as an anti-parasitic dressing, and in view of Hornby and French's experiments it is evident that it is an agent which must be used only with the greatest of care.

The Results Obtained with Tyrothricin in the Treatment of 157 Cows with Streptococcic Mastitis. By C. S. BRYAN, M. L. WELDY and T. GREENBERG. *Vety. Med.* Sept., 1942. *XXXVII, 9,* 364-369.

TYROTHRICIN is a bacterical agent extracted from a soil bacillus. It was discovered by Dubos (*Jnl. Exp. Med., 70,* pp. 1-7 and 249-256). Preliminary experiments employing it as an udder infusion suggested the possibility of saving many cows for continued milk production. 150 milligrams per quarter was the dosage used. 600 mg. of the powder was dissolved in 5 c.c. of 95 per cent. alcohol. The solution did not deteriorate, when sealed, during a period of one and a half years.

The contents of a vial were added to 100 c.c. of sterile tap-water just before treating a cow. This was sufficient for the four quarters. It should remain in the udder for a minimum period of six hours. As a result of the treatment on 157 cows with streptococcic mastitis: 142, or 90 per cent., were freed of the streptococcic infection; three cows did not drop in milk; 64 dropped from 1-50 per cent.; six dropped from 50-90 per cent. All were normal within 21 days. In 10 cows bacterial counts before and after treatment showed reductions varying from 30-99 per cent.

Ten references are quoted.

The Effect of Endocrines on the Animal Reproductive Organs and their Therapeutic Value. By S. K. CHANDHURI, G.B.V.C. *Indian Vety. Journal. XVIII. 5,* 229-257.

A résumé of the present knowledge, with 28 references. A useful type of article, for it enables the ordinary practitioner to keep abreast of the latest information on an ever-expanding subject.

Reviews

Diseases Transmitted from Animals to Man. (2nd Edition.) By THOMAS G. HULL, Ph.D., Director, The Scientific Exhibit American Medical Association. London: Ballière, Tindall & Cox. 30s.

IT is ten years since the first edition of this book was issued, and the fact that a second edition has been necessary shows that a book, although dealing

with a specialised topic, has met with a wide demand. Much new information has come to hand in recent years and the original chapters have been revised and brought up to date. New chapters on louping-ill, equine encephalitis, relapsing fever, etc., have been added.

The material has been classified into five sections, as follows: (1) Diseases of domestic animals and birds; (2) Rodent affections; (3) Human diseases spread by animals; (4) Animals as passive carriers of disease organisms; and, finally, (5) A review of the role played by each animal in the spread of disease.

Dealing with such a diversity of diseases the author has wisely sought the collaboration of many persons recognised as authorities in their own particular fields. As a consequence, the information is exact and up to date. It will be of great interest to English readers to read of the success of the American scheme to eliminate tuberculosis from their herds. Table 7, page 28, is particularly significant.

In view of the controversy which exists in this country re the pasteurisation of milk, it will be noted that proper pasteurisation has been found to be an absolute safeguard in America.

The statement that the horse is rarely affected with tuberculosis will not be accepted readily by those with experience in the British Isles. Donkeys and mules are said to be immune from the disease. Support is given to our policy of slaughter when dealing with foot and mouth disease, for it has been erradicated from the U.S.A. by those methods.

Brucellosis is discussed at length. That of the goat and pig are most pathogenic to man. Although Brucella abortus infects man at rather seldom intervals, it is stated: "If there were no other reason for milk pasteurisation it would appear to be folly to drink raw milk containing the abortus organism."

It is strange that no statistics are available as to the prevalence of glanders in horses. A gradual decrease in incidence has taken place. It is rather surprising to note on page 125 the number of human cases between 1920-1929. In 1929 there was 12 cases reported to the New York City Health Department. Fortunately, 1930 is marked by nil cases, a state of affairs which one hopes will persist.

Rabies is still of great consequence in America, as a glance at tables on page 149 will confirm. This is one disease in which our American friends would do well to follow our lead.

Psittacosis is said to occur most frequently in human females, probably because they are more in contact with pet birds. On the other hand, it is strange that in Australia, where there is said to be a tremendous reservoir among birds, less than 10 human cases have been recognised.

No infections of man have been noted in louping-ill endemic areas, but five laboratory infections have occurred.

The virus of equine encephalomyelitis is apparently very pathogenic to man. Of a total of 38 suspected cases in Massachusetts, 25 died. Fortunately, man is probably not very susceptible to infection. The European custom of slaughtering sick animals for food is responsible for the high proportion of illness due to meat. This statement cannot be denied and greatly strengthens the case of those

who advocate measures for a more stringent system of meat inspection in this country.

The number of diseases in man caused by animal parasites comes as a shock and one is inclined to wonder what the reaction will be when the list is finally complete. Tularemia, as befits a recently discovered disease (1921), has a good press. Ninety per cent. of human cases are acquired from rabbits. Domestic rabbits have never been known to acquire the disease naturally. Fortunately, there is an anti-serum of considerable value in the treatment of this most troublesome and highly infectious disease. In discussing diphtheria, it is said that the cow may become infected upon the udder and so be a serious menace by way of the milk supply. We wonder if it is not more likely that the menace is not the cow but the " carrier " milker. It is also stated that the cow's udder may become infected with scarlet fever streptococci, shedding enormous numbers of the cocci into the milk. Again, is it not more probable that the milker is at fault? The final chapter is most interesting, in that the author discusses the role played by the various species of animals and birds and their relation to man in health and disease.

The book has a wide appeal. It will be read with great interest by all who are concerned with the problems associated with comparative medicine. It is a credit to the author and his publishers, and in its pages is a great wealth of information. The illustrations and maps and tables are good. The bibliographical references will be most valuable.

War Gases and Foodstuffs—Chemical Warfare and Food Supplies. By W. R. WOOLDRIDGE. pp. 50. London. Food Manufacture. Leonard Hill, Ltd. Price 2s. 6d.

THIS publication, consisting of a Foreword by Sir Joseph Barcroft, a preface and nine chapters, will be found of much interest and value to members of the Veterinary Profession. It contains clear descriptions of the properties of war gases and the methods by which foodstuffs may be protected from gas contamination: in this section meat, meat products and fodder are dealt with. Sections also deal with methods of decontamination, including the treatment of livestock which has been exposed to the effects of the various gases. A valuable chapter deals with the detection of gas in foodstuffs. Those of us who have any responsibility concerning foodstuffs shall certainly profit by a perusal of this work and shall glean much knowledge on how to prevent their becoming contaminated and how to treat them should gas be used.

We recommend this book to our readers with every confidence.

PERSONAL

F. G. MANLEY, a boy of 12 years of age, has been awarded the Denham Scholarship, tenable at Epsom College.

Manley is the son of F. H. Manley, M.V.Sc., M.R.C.V.S., who has spent many years in the colonial service in Uganda, Nigeria and Cyprus.

The scholarship is one for the " Sons of men of British nationality who

have done meritorious service to the Empire within or more especially outside the United Kingdom."

This recognition of the work of one of our colleagues will give great pleasure not only to Mr. Manley's intimate friends but to the profession as a whole.

Although only 12 years old, young Manley has already shown great promise, and we are certain that the good wishes of his father's colleagues will go with him to Epsom.

May he be the first of a long list of veterinary surgeons' sons who will benefit through the proper recognition of their parents' work.

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